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A model for the development of sustainable innovations for the early phase of the innovation process

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Abstract

Current industrial development is faced by the global challenge to meet the continuously growing demand for capital and consumer goods in emerging countries while simultaneously ensuring a sustainable industrial growth in the social, environmental and economic dimension. By means of market dynamics of cooperation and competition in global value creation and knowledge networks, innovations geared towards sustainability can be essential drivers for realizing a sustainable development. The targeted development of new sustainable innovations is consequently a key activity in order to move towards sustainable industrial growth. This paper will describe a model for the development of sustainable innovations. The model focuses on idea generation in the early phase of the innovations process, addressing the fuzzy front end of innovation. In this context, specific goals and principles of sustainable development are integrated into a problem-solving approach. This integrated approach is subsequently used as a foundation for the targeted development of sustainable innovations in the frame of a workshop concept.

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1. Introduction

Global development is currently coined by some major trends such as an increasing socio-economic inequality, migration and displacement, urbanization, climate change and environmental degradation, which are leading our

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global community along a sustainably irresponsible development path [1,2]. Moreover, these trends bare the risk of significant incidents on a global and regional level, for instance the occurrence of extreme weather events, fiscal crises, or profound social instability [1,2]. In order to cope with these global trends and to foster a Sustainable Development, the United Nations have passed the so called UN Sustainable Development Goals (SDGs) [3]. These goals were adopted by 193 countries during the 2015 UN General Assembly, and can serve as a basis for generating new technological innovations. By means of market dynamics of cooperation and competition in global value creation and knowledge networks, technological innovations geared towards sustainability can be essential drivers for realizing a sustainable development. The targeted development of new sustainable innovations is consequently a key activity in the push towards sustainable industrial growth. This paper will describe a model for the development of sustainable innovations. The model focuses on idea generation in the early phase of the innovation process, addressing the fuzzy front end of innovation with reference to Sustainability Drivers and Innovation Drivers.

2. State-of-the-Art

2.1. Sustainable Development

The concept of Sustainable Development was first clearly defined in 1987, in the Bruntland Report, as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs" [4]. Although now a widely used and accepted term, the concept and practice of sustainable development still maintains a significant degree of ambiguity, which has led to a variety of different interpretations [5]. Since the conception of this idea of Sustainable Development, its interpretations have been largely dominated by three main approaches: status quo, reform and transformation [6]. The status quo approach to sustainable development argues that, while changes in the environment and society are necessary, our current political and economic institutions can achieve the necessary results without any alterations [6]. Supporters of such an approach see growth, and specifically economic growth, as part of the solution for Sustainable Development, as well as business, private ownership, improved management and new technology [6]. The reform approach believes that significant changes in current policy and lifestyle will be necessary in order to achieve Sustainable Development [6]. Supporters of this policy generally argue that technology, increased energy efficiency, market modification and regulation such as the internalization of environmental costs, and increased democracy can solve the problems that Sustainable Development seeks to tackle [6]. The transformation approach is the most radical of the three, arguing that our environmental and societal problems are caused by the fundamental structures of society, such as our political and economic institutions, and that major changes to these structures are necessary to overcome the current challenges [6]. Proponents of this approach generally believe that the solution lies in involving marginalized groups outside of the normal centers of power, such as indigenous, poor, working class and women. They draw a strong link between social equity battles and environmental concerns [6].

Another framework used to differentiate between conflicting interpretations of Sustainable Development is that of weak versus strong sustainability. In this context, the definition of Sustainable Development can be reframed as development that maintains "the capacity to provide non-declining per capita utility for infinity" [4]. These two opposing paradigms, weak and strong sustainability, differ mainly in how they believe this capacity must be maintained [4]. Weak sustainability holds that the total net investment of capital must be greater than zero, without differentiating between different types of capital, and hence relies on the assumption that natural capital is unlimitedly substitutable [7]. As long as there is greater investment in man-made capital than loss of natural capital, Sustainable Development is achieved [7]. In contrast to weak sustainability, strong sustainability holds that natural capital is fundamentally non-substitutable [7]. Under this paradigm, investment in other forms of capital, such as man-made capital, cannot make up for the loss of natural capital [7]. Hence, to maintain a total net investment greater than zero, any degradation of natural capital must not exceed its regenerative capacity [7].

A common thread that links these different interpretations of sustainability is the three focus areas, often referred to as the three pillars of sustainability: the environment, society, and the economy [5,6]. However, specific views on the relative importance of each factor, and the ways in which they interlink, are varied. For example, some may model these factors in a Venn-type diagram, with three separate but connected rings, implying a certain degree of independence and trade-off between the three pillars [6]. An alternative model is that of three concentric circles, the